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ABSTRACT

This document describes teaching techniques that vocational and academic teachers can use jointly to improve students' basic skills. It is part of BASICS, a package of integrated materials developed to assist teachers, administrators, and counselors in bridging vocational and academic skills. Section 1 focuses on the problem of students' basic skills deficiencies and how teachers can respond. Section 2 specifies and discusses ways that teachers can work. The options include sharing, teaming, and staff crossover. The final section consists of examples of eight programs in which teachers have successfully used these strategies to integrate vocational and academic education. They are Pathfinder Regional Vocational-Technical High School District (Palmer, Massachusetts), Joint Academic Vocational Approach (Kentucky), Dauphin County Area Vocational Technical School (Harrisburg, Pennsylvania), Program Options (Ohio), Ohio Program Options: Great Oaks Joint Vocational School District (Cincinnati), Ohio Program Options: Mathematics at Montgomery County Joint Vocational School (Clayton), Principles of Technology as Applied at Detrick Vocational Center (Louisville, Kentucky), and Process Model for Integrating Science Concepts and Vocational Skills, Sandy Union High School (Sandy, Oregon). A conclusion summarizes, in the form of a checklist, the factors that should be considered before making the commitment to joint efforts. (YLB)

Basics
Bridging Vocational and Academic Skills

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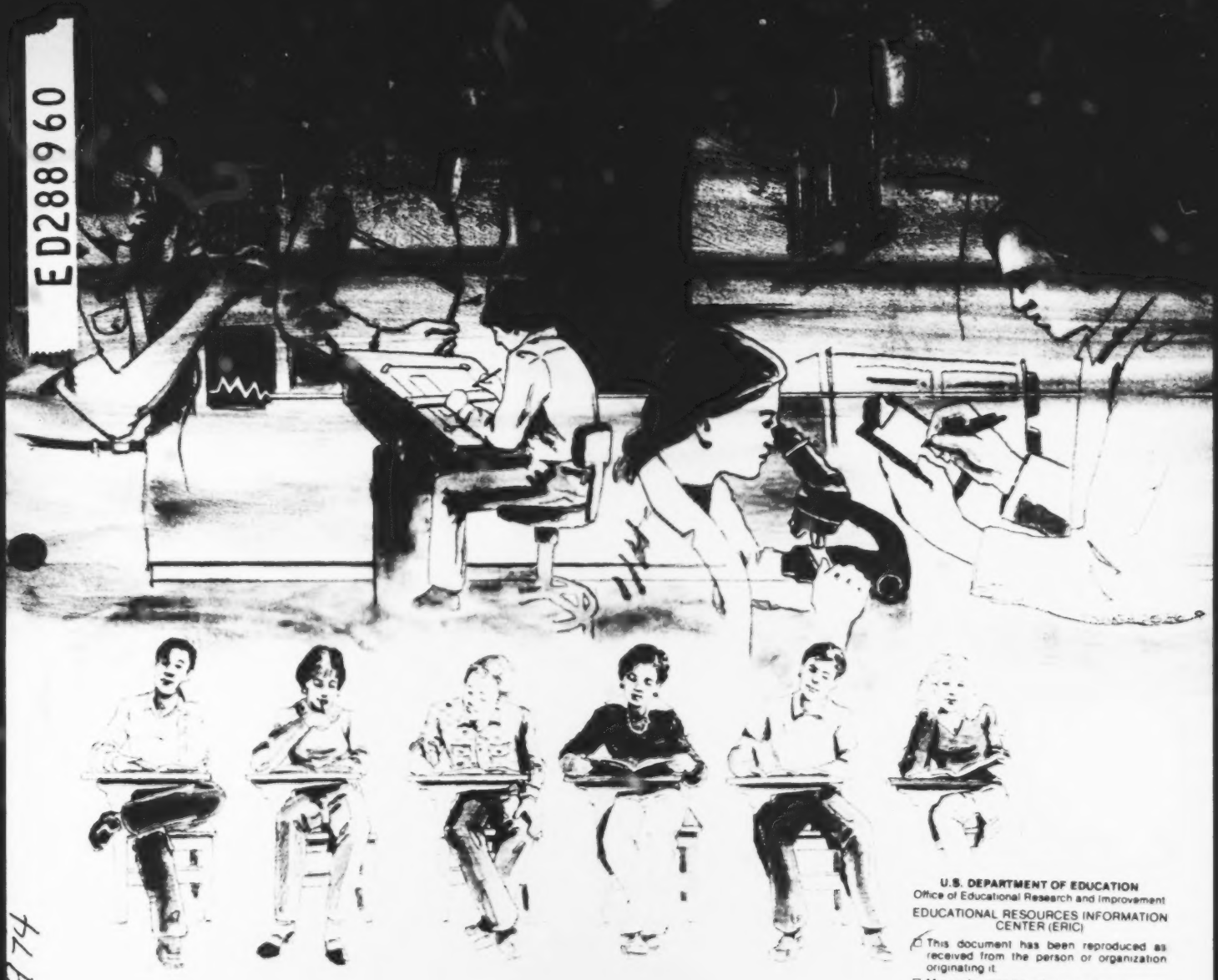

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Strengthen basic skills by using . . .

TECHNIQUES FOR JOINT EFFORT: THE VOCATIONAL-ACADEMIC APPROACH

A Targeted Teaching Technique

Adapted by

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FOREWORD

Converging factors point to a need to look for new pathways to vocational education excellence: the public's increased expectations regarding academic outcomes of education, heightened by a number of national reports; increased graduation requirements and declining vocational enrollments in many states; the emphasis in the Perkins Act on the need for strengthening academic foundations; and business and industry requests that entry-level employees have a more thorough knowledge of the basic academics they will need to apply in their vocational fields. Those concerned agree that students need to have stronger basic academic skills as they leave secondary education programs—stronger academic skills for graduation, for work, and for life.

The National Center has sponsored diverse efforts dealing with basic skills in vocational education, from research to development to dissemination. Much has been learned about vocational students' basic skills learning problems. In order to make connections between research and practice, The National Center has, through synthesis and development, prepared an integrated package for teacher use, reinforcing this information with practical applications gleaned from teachers' repertoires across the nation. The products in the package are aimed toward enabling vocational and academic teachers to strengthen the academic component of vocational programs through joint effort.

The **BASICS** package provides resources in five focus areas: research findings, teaching techniques, instructional materials, instructional strategies, and support roles. The resources are organized in three looseleaf guidebooks for flexible use. An accompanying videotape provides an orientation to the topic and to the package.

The Bridger's Guide orients administrators, counselors, teachers, and employers to the purpose and application of **BASICS:** individual roles are explained, resources identified, and implementation guidelines and strategies outlined in workshop format. Individual components to the guide are as follows:

- *Implementation Guide* describes the philosophy of **BASICS** and provides guidelines for implementing the program.
- *Support Roles for Basic Skills* describes the role of administrators, counselors, employers, and families in a program for improving basic skills.
- *Primer of Exemplary Strategies* provides teachers with examples of other teachers' successful efforts and diverse approaches.
- *Roadsigns from Research* (posters and brochures) highlights key research findings of interest to those involved in strengthening basic skills.

Targeted Teaching Techniques provides vocational and academic teachers with assessment, planning, and management tools to improve students' basic skills. Individual components are as follows:

- *Technique for Management: Time for Learning* lays foundations for more effective basic skills instruction through studying the use of classroom time.

- *Technique for Remediation: Peer Tutoring* discusses the planning, implementation, and evaluation of peer tutoring programs to strengthen students' basic skills.

- *Technique for Computer Use: Software Evaluation* describes a procedure for joint evaluation of educational software for basic skills instruction.

- *Technique for Individualization: The Academic Development Plan* guides school staff through a systematic identification of individual student needs and steps to meet those needs.

- *Techniques for Joint Effort: The Vocational-Academic Approach* describes teaching techniques that vocational and academic teachers can use jointly to improve students' basic skills.

Developing an Instructional Program provides teachers with practical and theoretical information on the development or selection of appropriate applied basic skills instructional materials. Individual components are as follows:

- *Instructional Materials Development* discusses the prerequisites of materials development, alternative curriculum types, and guidelines for materials development and review.

- *Supplemental Instructional Resources* identifies sources of basic skills instructional materials for use with vocational students.

- *Instructional Assistance in Specific Basic Skills* prepares vocational teachers to help students gain reading, writing, oral communications, and math skills.

The National Center wishes to acknowledge the leadership provided to this effort by Dr. Robert E. Taylor, recently retired Executive Director. Appreciation is extended to the following individuals who served as a panel of experts to assist staff in planning strategy and recommending document content: Eugene Bottoms, Consultant to the Southern Association of Colleges and Schools; Michele Brown, Vocational Supervisor, Idaho Falls School District, ID; Alton Crews, Superintendent, Gwinnett County Public Schools, GA; Roger Faulkner, Instructor-Coordinator, Great Oaks Joint Vocational School District, OH; and Darrell Parks, Director, Division of Vocational and Career Education, Ohio Department of Education. Appreciation also is extended to Ron Von Stein, Pioneer Joint Vocational School, Shelby, OH and to Lois Harrington of the National Center for their critical review of the document.

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Chester K. Hansen
Acting Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

Students need to have strong academic skills as they leave secondary education programs—strong academic skills for graduation, for work, and for life. Studies of education have advocated a renewed emphasis on academic excellence and on teaching basic skills, and many states have responded by increasing graduation requirements. Employers want to hire graduates who have a strong foundation of basic skills and who can apply those skills to solve problems in an increasingly technological world that demands great flexibility of workers. Finally, students need to master basic skills to successfully participate in our complex society.

Educators in many places are responding to this challenge in ways that have positive outcomes for their students and, ultimately, for themselves. Evidence of this has been gathered by The National Center and is being published by The American Association for Vocational Instructional Materials (AAVIM) in *Integration of Academic and Vocational-Technical Education: An Administrator's Guide* (Harrington, in press). The evidence relates to the need to link academic skills instruction to applications in vocational tasks for successful student learning. The challenge can best be met by a joint effort of vocational and academic teachers to bridge the gap between vocational and academic programs and to make students aware of the bonding between academic skills and vocational tasks.

For this document, information of interest to teachers has been drawn from Harrington's work. Ways that teachers can work together are specified and discussed so that teachers can work out how to proceed with joint effort in their own situation. The options include sharing, teaming, and staff crossover. Sharing involves planning and preparing for instruction cooperatively as well as sharing concerns about how to deal with change and new relationships. Teaming may involve the development of a correlated course of study and instructional materials to incorporate the vocational and academic content as well as teach the content. Staff crossover entails systematic exchange of selected responsibilities.

The final section of the document consists of examples of programs in which teachers have successfully used these strategies to integrate vocational and academic education. Many of the teachers in these programs have instituted pioneering joint efforts from which other teachers can benefit.

Advice from the field:

Educational reformers have long called for vocational and academic teachers to collaborate in developing a field: balanced curriculum—one in which such studies as English, science, mathematics, graphic arts, and electronics would collectively enlarge understanding of the workplace and, in turn, correct some of the traditional perceptions and stereotypes described here. The Commission believes that both general and vocational education leaders must undertake to integrate their curricula and demonstrate the co-equal importance of academic and vocational learning. In doing this, we will be more responsive to the unique needs of all students in our nation's secondary schools.

It is as unfair to limit the vocational education opportunities of academic students as it is to stigmatize those who are in the programs. We need an enriched vocational curriculum that serves all students, regardless of their academic ability or aspirations. We should give all students a balanced mix of academic and vocational experiences in their high school curriculum. We should provide vocational experiences for all learners and not stigmatize such courses as the exclusive preserve of special groups.

The problems and possibilities in vocational education mirror those in academic education. In both areas, learning is compartmentalized into arbitrary pockets called "courses." Students are seldom asked and seldom expected to integrate skills and knowledge across these courses. Opportunities for rote learning, applicative learning, problem solving, and creativity are inherent in academic and vocational courses alike; similarly, enriching and boring experiences take place in both realms.

What is really required today are programs and experiences that bridge the gap between the so-called "academic" and "vocational" courses. The theoretical and empirical bases as well as the practical and applicative aspects of academic courses and vocational courses must be made explicit and meaningful. This calls for a joint effort between the academic teacher and vocational teacher.

National Commission on Secondary Vocational Education.
The Unfinished Agenda: The Role of Vocational Education in the High School.

Introduction

What Is the Problem?

Several factors have converged to make changes in vocational education programs a necessity:the public's increased expectations regarding academic outcomes of educational activities, heightened by a number of national reports; increased graduation requirements and declining vocational enrollments in many states; the emphasis in the Perkins Act on the need for strengthening academic foundations; and business and industry requests that entry-level employees have a more thorough knowledge of the basic academics they will need to apply in their vocational fields.

None of these reasons imply failure on the part of teachers—academic or vocational—to "do their job." Rather, these factors are part of a collective set of circumstances that point to a need to look for new pathways to vocational education excellence. Those concerned agree that students need to have stronger academic skills as they leave secondary education programs—stronger academic skills for graduation, for work, and for life.

Academic Skills for Graduation

The problem of students' basic skills deficiencies is a national concern for both general and vocational educators. Since the sixties, educators have seen test scores decline, reflecting deficiencies in basic skills. This "rising tide of mediocrity"—to quote the National Commission on Excellence in Education—finally captured widespread national attention in 1983 when several reform documents were published, including *A Nation at Risk*. Many of these documents advocate a renewed emphasis on academic excellence and on teaching basic skills.

These studies stressing the needs in education have led states to respond in a number of ways, such as—

- increasing teacher certification standards,
- increasing the number of academic courses required for graduation,
- changing curriculum standards for graduation requirements,
- changing curriculum standards or textbook adoption procedures, and
- lengthening the school day or year.

Many of these responses involve changes in graduation requirements. The changed requirements demand that basic academic skills be strengthened and also that schools be accountable, giving evidence that specific skills are being taught in specific courses so that students can qualify for graduation.

Increasing academic course work creates a problem for vocational students: the effort to meet the new graduation requirements leaves them limited time to participate in vocational-programs. Thus, enrollments in many vocational programs have been decreasing.

For students who are "at risk" in terms of their decision to stay in school long enough to graduate, the new academic demands are

SOURCE: The material in this document has been largely exerpted and adapted for teachers from Harrington, *Integration of Academic and Vocational-Technical Education: An Administrator's Guide* in press. Material in the second paragraph on this page is adapted from an unpublished Ohio Program Options work.

frightening and discouraging. Since many at-risk students have tended not to do well in more abstract academic courses but have done better in more concrete vocational courses, the problem is compounded.

Academic Skills for Work

Employers are among those who have been pointing out the deficiencies in basic skills of those they employ or would like to employ. Clearly, employers want to hire graduates who have a strong foundation of basic skills. The major thrust for employers' demands comes from the changing nature of work—a phenomenon with many facets. One is that declining U.S productivity, coupled with increasing competition abroad, points to a need to have workers who will contribute more effectively on the job.

Second, partly because of technological change, occupations requiring few or no basic skills are rapidly disappearing, while newly created occupations require workers to use reading, writing,and computation at a fairly high level of skill in the solving of daily problems on the job. Technological change also means that people may be expected to change jobs relatively often. People with strong academic skills and an understanding of broad principles are in a much better position to be flexible in transferring those skills to new applications than are people who have only narrow (and soon obsolete) occupational skills. Employers are stressing the need for problem solving and decision making skills and for the ability to apply academic concepts to specific tasks.

In a survey conducted at Pensacola Junior College, employers said they wanted graduates to possess direct job skills (e.g., welding) because these skills equip an individual to begin a job. They also wanted other, related skills (e.g., safety-mindedness, human relations, communications) because these skills equip a new worker to keep the job. (Walker, 1980)

Academic Skills for Life

Students' mastery of basic skills is essential to their successful participation in our society. These skills are not only crucial to demonstrating employability and occupational competency, acquiring further education and training, and attaining upward mobility, but also necessary for functioning in a complex society. Students need more than job training to live full, satisfied, productive lives. As expressed by the Association for Supervision and Curriculum Development in their Resolution 10 (ASCD, 1986) for a balanced curriculum:

> "A limited interpretation of the basics required in education threatens a balanced and high quality curriculum for students living in our complex society. The curriculum should be broad enough to offer suitable educational opportunities for all students relative to their academic, social, psychological, and health needs and abilities. ASCD recognizes that further development and emphases are needed in teaching skills of problem solving, reasoning, conceptualization, and analysis, which are among the neglected basics needed in tomorrow's society." (p. 1)

What Are the Skills Needed?

There seems to be general agreement that the following skills are necessary:

- **Entry-level job skills**—More than entry-level skills are not, in most cases, required or even desirable. There is not time to teach more than that. Employers don't want more than that. And since skills become obsolete so quickly today, it is counterproductive to teach more than that. Retraining, perhaps five to seven times, will characterize careers of the future—lifelong learning.
- **Common-core basic skills**— Math, science, and communication (reading,

writing, listening, speaking) skills need to be taught through instruction, remediation, reinforcement, and application. Computer literacy is another common-core skill that is becoming basic.

- **Job-specific basic skills**—Students training for certain occupations may require additional academic course work. For example, students in electronics or health occupations may need to take specific science courses.
- **Employability skills**—The skills needed to get a job include interviewing, conducting a job search, developing a resume, and completing a job application form.
- **Employment skills**—The skills needed to keep a job and advance in the occupation (or move laterally if needed) include interpersonal skills, educability skills, thinking skills, problem solving, decision making, the ability to cope with change, risk taking, innovativeness, entrepreneurship, and leadership. Also included are the many affective elements desired by employers:punctuality, reliability, safety-mindedness, perseverance,cooperation, loyalty, enthusiasm, and confidence.

Although vocational instructors will recognize most of these skills as being a part of their present programs, the message from employers and others is clear: More is needed! Present programs have not been judged to be inferior—and specific programs are acknowledged to be superior—but overall, vocational education has often been judged to be ho-hum, so-so, mediocre. That should be a challenge. Vocational educators have always sought excellence; by linking more closely with academic colleagues, by pooling respective strengths, vocational educators can greatly enhance the quality of education for all students.

Can Teachers Respond?

Having acknowledged that the problem is real, teachers—both vocational and academic—in many places across the nation have decided and are deciding that they can respond to the challenge in ways that have positive outcomes for their students and, ultimately, for themselves.

The following exhibit typifies this "can do" spirit and gives a list of areas in which teachers can make their efforts count.

EXHIBIT 1
"CAN DO" ARTICLE

The legislative provisions in the Perkins Act that encourage the strengthening of academic foundations of vocational education programs are welcomed and applauded. The liberal interpretation of these provisions—to encourage courses and instructional strategies for teaching principles of math and science via practical application—provides a necessary staple to the vocational education diet. The more broad, global interpretation of the legislative intent—to consider academic and vocational course work as a fused,coordinated curriculum for all students—is tempting food for thought.

The 31 words of Title II, Section 251, a(11) of the Perkins Act provide the major impetus to strengthen academic foundations of vocational education. This legislative provision indicates that states may use funds for—

> the conduct of special courses and teaching strategies designed to teach the fundamental principles of mathematics and science through practical applications which are an integral part of the student's occupational program

Though some may look upon the "may" component of the legislation as weak, this legislative statement is highly significant. Efforts to strengthen academic foundations, not highlighted in previous vocational education law, signal a recognition of the importance of underlying academic principles applied to vocational education. This signal has the potential of being highly influential to state legislators and state and local policymakers. Further, the legislative provision gives credence to the long-held belief of many educators that the mutually exclusive approach to curriculum is no longer applicable. Business and industry, the compass for direction in vocational education, has supported this notion for some time. At a local level, employers have repeatedly voiced the need for academic skills as foundational to vocational skills. In *High School and the Changing Workplace: The Employer's View*, business/industry leaders recommended core competencies vital for almost every job. The competencies, transferable in nature and essential for adaptability, include a significant emphasis on academics.

It must be pointed out, however, that business and industry representatives did not request more academics per se, but *applied* academics. Such requests have frequently been misinterpreted, as expressed by Janet Hunt, Standard Oil of California, in *A Nation at Work: Education and the Private Sector:*

> A good example of misreading industry feedback to educational needs is the back-to-basics backlash. Industry people have been strongly advocating better business-English skills training and . . . this has been interpreted by some legislators/educators as four years of English literature.

Composers of legislation should be commended for providing language that stresses application of academics that are an integral part of the student's vocational program. They did not request *more* academics—a quantitative crevice out of which many critical education reviewers have not yet climbed.

EXHIBIT 1—*continued*

Purpose, Priorities, and Potential

Application of this legislative provision has exciting potential. It provides a "WE CAN" approach not only to vocational education curricula but also to education curricula as a whole. With the general intent of the legislative provision—

WE CAN assist students with lifelong learning skills. Clearly, academics are fundamental to occupational programs, but they are significant factors, as well, in learning how to learn. This learning-how-to-learn is paramount to the retraining and reorienting of individuals encountering new jobs, which occurs five to seven times in the average person's work life.

WE CAN motivate students to learn both the vocational and academic skills. In *The Unfinished Agenda*, the National Commission on Secondary Vocational Education noted that vocational education is frequently "the catalyst that reawakens" student interest in school and "sparks a renewed interest in academics." This reawakening and sparking of interest has been evident in vocational programs in Ohio that have stressed applied academics.

WE CAN broaden opportunities for academic students. Students in the college preparatory track who have the opportunity to see the theories of math, science, or communication put to practice have a scope that is widened in terms of realism. The meaning of the subject matter is expanded.

WE CAN broaden opportunities for vocational students. Students in vocational programs have the opportunity to see that the practices and activities within their respective skill areas are based on sound principles and theory that carry over to other program areas.

WE CAN alter the perception of the public toward certain disciplines. Schools in which the vocational programs encompass principles of mathematics, physics, chemistry, and advanced communication will foster a more positive image of both vocational and academic programs.

WE CAN be pace-setters in the educational arena. Critics have urged that education needs to be more applied, more concrete, more related to the real world. A basic and accepted principle of teaching and learning relates relevancy and application to increased comprehension. Despite this, many academic classes function with little or no application. Vocational education, on the other hand, has by its very nature a history of applied learning. The marriage of vocational and academic content can provide the vocational education community opportunities for leadership in instructional design.

WE CAN help vocational students accelerate the pace and depth of understanding of their skill development. When students comprehend the principles upon which the application of knowledge is based, they will be better equipped to see application and relevancy of newly evolving knowledge. This will allow a greater level of efficiency and effectiveness in the classroom and on the job.

SOURCE: Darrell L. Parks and Gail H. Henderson, "Strengthening the Academic Foundations of Vocational Education Programs: A New Charter—A New Look" (Columbus, OH: Ohio Department of Education, Division of Vocational and Career Education, n.d.), pp. 1-4.

How Best to Respond?

Fortunately, there is prodigious evidence that when basic skills are linked with and applied to technical skills, students are willing and able to master them. Therefore it is important that academic and vocational learning be viewed as complements, never substitutes, for one another. The unhealthy schism that often exists between academic and vocational programs can be bridged for the betterment of all students if it is recognized that each has much to offer the other and that the new educational challenges of our day can best be met through concerted action. The challenge is twofold:

- to strengthen the academic basis of vocational education, and
- to strengthen the connection between concept learning and application in academic education.

The challenge can be best met by a joint effort between vocational and academic teachers to design educational programs that apply the academic skills in the context of an occupational area. The thrust toward a joint vocational-academic effort has several underlying premises:

- *Academic basic skills are embedded in vocational tasks.* Both academic and vocational teachers are needed to identify exactly where academic concepts are used in vocational courses.
- *Vocational tasks provide for realistic use of academic basic skills.* Often academic textbooks do not provide sufficient opportunities for students to practice such skills. Connecting academic learning with application strengthens students' basic skills and builds the skills they need for problem solving and decision making.

Clearly, students should learn to apply academic concepts in ways that have real-world consequences. It is important to capitalize on the natural environment of the vocational setting where students can apply the academic concepts.

- *Neither academic basic skills nor vocational skills should be taught in isolation from each other.* All teachers need to make students aware of the bonding between academic basic skills and vocational tasks. This requires a fusing of vocational and academic education. As Rupert Evans says,

  > One of the first ways to make vocational and general education everyday partners is to establish instructional programs which point out to students that instruction in every class is relevant to what they are now learning, and will be relevant in their lives ahead. Since we do not want to tell students an untruth, we need to make sure that all education really is relevant. (Evans, 1971, p. 58)

- *Differences in students' learning styles and in teachers' teaching styles may have a significant impact on successful basic skills acquisition.* If some students learn more successfully through an academic, abstract approach and others through an applied, concrete approach, schools had better provide for both.

Many of the reforms being instituted have a structural emphasis in that they add on to the system (for instance, lengthening the school day). The joint vocational-academic approach, on the other hand, is more process-oriented. It involves a cooperative effort to reexamine program/course structure, staffing, curriculum design, and teaching techniques. This redirection of effort does not involve costly changes and shows real promise of strengthening basic skills for all types of students.

The exact process by which academic and vocational teachers can work effectively together will vary according to the local situation. However, as with all desired changes, it helps to know some of the factors to consider and the strategies that are being used successfully elsewhere and can be considered among the options. The next chapter discusses these.

Ways Teachers Can Work Together

A variety of options exist for vocational and academic teachers to cooperate in a joint effort. The aim is an integrated and articulated program in which vocational students receive academic and occupational instruction presented as a total education package. To achieve this, educators must stop assuming that "what" is taught is tied to "where" it is taught—that communication is taught in English, math is taught in math class, physics is taught in science, and engines are taught in shop. In fact, communication competencies can be identified in many places in the curriculum, and the same is true of the other disciplines.

If the aim is an integrated and articulated program for students, these concepts deserve some discussion. Integration is the blending of the "what" into the various "wheres"—interrelated and parallel coverage of content in academic, related, and lab classes. Articulation is the process of matching competencies to task lists and identifying where the competencies are (or should be) taught. This occurs both vertically (between successive years and levels of schooling) and horizontally (across the curriculum). The result is a coordinated, efficient system of covering all the required competencies.

The first and broadest group of options for cooperation can be called simply "sharing." Other categories of options include teaming and staff crossover; these all have some elements in common.

Sharing

Sharing and cooperation involve people, and without them integration cannot effectively happen. Administrators and staff must work together in integrating and articulating their instruction to create a total education package. Cooperative sharing is not sufficient for integration, however. Integration must be inherent in the curriculum and the program structure as well. Thus, a major degree of sharing must take place in the planning process.

Planning

The planning process must include those who will be involved in the program—administrators, teachers, guidance counselors, etc. The teacher's role in planning will be stressed here. Planning for the joint effort involves, first, an agreement on the skills that will be considered "basic" in the program—that is, the types of academic skills vocational students will need as a foundation to their mastery of occupational skills and their ability to move flexibly on the job and in life.

Second, it is helpful to assess some of the cooperative aspects of the existing program. Vocational and academic teachers can share the ongoing informal and/or formal efforts being made to strengthen academics within the vocational curriculum, and occupational applications within the academic curriculum. Many of these efforts may already be underway without an explicit organizational commitment having been made.

Once this planning groundwork is laid, some questions about structure arise.

Who will teach the academic skills? In some institutions and in some states, vocational educators are identifying the academic skills they already teach in their programs and are seeking—and being granted—approval to award academic credit toward graduation for academic skills learned through vocational instruction. Proponents of this approach claim, with some validity, that a great deal of math or science or English is already taught in vocational classes because the academic skills are essential to successful performance of the occupational skills. Many an electronics teacher provides science instruction. Many a business teacher provides English instruction. Many a carpentry teacher provides math instruction.

Other institutions and states feel that to assure high-quality academics worthy of graduation credits, certified academic teachers must provide the academic instruction, correlated with and reinforced by the occupational instruction. To do otherwise, they feel, makes teacher certification standards meaningless. In fact, there is evidence that, although vocational teachers possess the academic *skills* needed for occupational tasks, they often do not have the expertise to explain the *theory* underlying the skill. That is one of the concerns of those urging educational reform.

Who will teach the vocational skills? In some cases, one vocational teacher teaches both shop and related instruction. In other cases, different teachers handle the two instructional tasks or use a team approach to teach both. Taking into consideration the present staffing structure and the demands of the proposed integration effort, those involved in planning need to determine how responsibility for teaching the vocational curriculum will be handled in the future.

What effect will the organizational structure have on your ability to integrate subjects? Can the structure be modified or changed? The educational institution may house both academic and vocational students and teachers, all under unified leadership. Since the teachers are all under the same roof, getting them together is not a physical problem, though it may require scheduling changes.

The institution may house only vocational students, but may have both academic and vocational teachers to provide a total program for those students. As in the previous situation, the actors involved in the change are at least all under the same roof.

Or the institution may house only occupational students and teachers, with academic students and teachers housed at home schools. The vocational students may complete their academic work prior to or concurrent with their vocational course work. Change to a more integrated system is no less possible in this situation but does involve some additional concerns. For example, when teachers are housed in separate facilities, *many* different, geographically distant locations may be involved, depending on the number of home schools and the size of the district. That makes interaction among teachers more of a challenge. Strong cooperative relationships may be impeded by the institutions' competition for students in the face of declining enrollments.

Planners need to consider the structure and the level of integration sought in making decisions about whether the structure should remain the same or change to facilitate greater integration. There are numerous options.

- Team vocational and academic teachers to promote sharing.
- Cluster the teachers in each vocational program with a math, science, and English teacher.
- Give academic teachers a vocational supervisor, and vocational teachers an academic supervisor to promote a cross-pollination of ideas and approaches.
- Form a vocational-academic team to supervise teachers from both groups.

What curricular materials will be required, and how will they be secured or developed? Poor and even mediocre materials can be the basis for a good deal of discontent. Many teachers have felt the lack of resources for the

teaching of applied academics (textbooks, guides, software) to be a major barrier.

The lack of resources is particularly critical given that, in many cases, students in a class represent a wide range of ability levels. Thus, it is recommended that the classes be *individualized* as much as possible. If the total vocational program is competency-based and individualized, adopting the same approach for the academic subjects should not constitute a major problem. If conventional group-based instruction is the institutional norm, however, individualization—particularly without adequate, appropriate curricular materials—can seem an awesome task.

Some integrated materials are already available or in development. The Center for Occupational Research and Development (CORD) and the Agency for Instructional Technology (AIT) have developed applied science courses for secondary and postsecondary vocational-technical students, entitled Principles of Technology and Unified Technical Concepts. CORD is also developing materials for applied math, while AIT is developing materials for technical communications.

Practical Exercises in Applying Knowledge (PEAK) is a program of secondary school curriculum materials developed by the National Center for Bell and Howell Publications Systems. PEAK places students in real-life situations by relating academic skills to the workplace. With a teacher's guide and series of student exercises, PEAK relates courses in math, science, and office and marketing education to today's careers.

In some cases, state or locally developed materials can be located through such sources as the National Network for Curriculum Coordination in Vocational and Technical Education (NNCCVTE). Often, however, teachers are happier using such materials if they develop—or at least adapt—them. This suggests the need to plan for curriculum development, an activity that takes both time and special skills. These issues are covered in detail in **BASICS'** *Instructional Materials Development* and *Supplementary Instructional Resources.*

Who else needs to be involved in the effort? The integrated educational program will gain strength if all the significant actors in the student's education are involved in the joint effort. Guidance counselors can play an important role in helping to assess students' basic skills levels. They can organize a systematic process for planning an individualized academic development plan for each student. (See **BASICS'** *Technique for Individualization: The Academic Development Plan (ADP).* Special educators need to be an integral part of the effort, as do parents and employers. It is worth spending some time considering all those who might be able to play a part in the new program.

Once these questions are answered, logistical arrangements can be made to support the effort. While vocational and academic teachers can provide input on support concerns such as space and time, administrators will usually need to coordinate arrangements.Many support issues relate to time concerns: time to plan; time to meet; time to share. This one concern can make or break the integration effort. If teachers cannot reasonably find the time to get together, they are unlikely to do so. Without this interaction, there can be little cooperation, correlation, or integration. Little team spirit will be built. If, however, at a bare minimum, teachers meet for ten minutes a day, that sharing is likely to become a habit.

One very effective way to provide time is to phase in the change over an extended period. This not only provides more options for building in the time needed for planning, developing, and implementing the innovation; it also provides time for all the participants to go through the change process to the point where the innovation is routinized, refined, and institutionalized—an integral part of the curriculum.

Preparation

Another crucial issue is adequate training. Inservice training needs to be available so teachers can feel adequately oriented to the integration approach to be used. They may also want training to perform the occupational and task analyses required, to use the task

analyses to identify academic skill requirements, and to develop curricular materials. Training vocational and academic teachers together helps to reinforce a cooperative relationship by providing an environment conducive to sharing.

Vocational and academic teachers may also need additional preparation in each other's fields. Academic teachers can offer workshops to help vocational teachers improve their own basic skills. Vocational teachers can offer minicourses covering occupational skills to help academic teachers relate their instruction to occupational reality. Academic teachers can be invited to vocational teacher conferences to promote sharing of ideas and materials. (See also **BASICS'** Performance-Based Teacher Education Modules, *Instructional Assistance in Specific Skills.)*

Additional preparation can take place through informal sharing. For example, vocational and academic teachers may seek each other's help in private or borrow each other's texts for study.

Sharing Concerns

It is natural for both vocational and academic teachers to have concerns about change. Some of these concerns need to be shared with administrators to find out some of their thinking and to make them aware of the feelings. It also helps for teachers to share their concerns—to seek answers, to seek help, and to develop a spirit of sharing and trust.

Some typical concerns of both academic and vocational teachers are the following:

- How will this change affect my job—especially my job security?
- Will I be relinquishing control over what I teach?
- How will I find time to cover the vocational content if more time is spent on academics? (or) How will I find time to cover the academic content if more time is spent on applications?
- How much additional work will be involved in the change, and how will I find the time and energy to do it?

Vocational teachers may wonder how strong their own academic skills need to be in order to teach others. They may also wonder how they can develop the needed skills.

Academic teachers may be concerned about their ability to relate their subject matter to occupational reality. Some may be concerned about the wisdom of doing so; they may worry about keeping their subject matter "pure," not watered down.

The experiences of many other teachers in pioneering joint efforts have indicated that such concerns are normal but can be alleviated and ultimately dispelled. The positive results for both students and teachers soon become paramount in their thinking.

Teaming

The central idea of teaming is that a vocational teacher and an academic teacher perform *some* of their teaching tasks together rather than independently. Teaming between vocational and academic teachers can take place in various ways. This is sharing the actual teaching rather than sharing about teaching. Several modes of teaming will be discussed here, but others can be devised.

Develop a Correlated Course of Study

Identify academic skills within vocational tasks. Initially,vocational teachers (usually with some sort of external help and advice) identify or update a list of essential entry-level tasks. Next, a vocational-academic team identifies specific academic concepts in those tasks on a task-by-task basis. The vocational

teacher can explain the task, since the academic teacher may be unfamiliar with it, and can often point out where academic skills are embedded, although sometimes the vocational teacher has come to take them for granted in practice and is less apt to recognize them. The academic teacher helps to identify them and applies specialized terminology, perhaps identifying the name of a principle, such as Boyle's law.

In some institutions, two types of basic academic skills are identified. By comparing the academic skill lists for all occupational programs, *common-core* basic skills are identified—skills needed in every occupational area. A second group of basic skills can then be identified—those that are *occupation-specific.* (A process for accomplishing this is described in **BASICS'** *Instructional Materials Development.*)

Correlate the courses of study. The vocational instructors develop a course of study based on the occupational skills identified. The academic instructors develop courses of study based, at least in part, on the academic skills identified (other academic skills required for graduation must, of course, be included). Then the team correlates the academic and vocational curricula as much as possible. For example, if the math teacher is teaching a particular *theory* during the first week of October, the vocational teacher should be teaching a skill that requires the *application* of that theory during the same week. Those experienced in integrating programs caution, however, that a perfect dovetailing of content is impossible. Some skills in each area are prerequisites of other skills; they must be taught in a particular sequence, and the academic and vocational sequences may sometimes be at cross-purposes. In addition, schedules slide a bit based on how long it takes students to master each skill.

Academic and vocational teachers work together to plan how individual lessons can be correlated. Vocational teachers give academic teachers relevant examples and terminology to use in teaching a given theory or skill. Academic teachers give vocational teachers suggestions for activities that require students to apply the theory and practice the skills.

Develop Instructional Materials Incorporating the Vocational and Academic Content

The team can jointly review the materials already in use in their courses as well as other existing materials. Their review may include software, for which a joint review procedure is explained in **BASICS'** *Technique for Computer Use: Software Evaluation.* Then they identify where changes need to be made and which team member is best suited to make those adaptations (with the other's review).

If new instructional materials are to be developed, the team needs to work out the guidelines for that process. **BASICS'** *Instructional Materials Development* describes specific procedures for accomplishing this task.

Teach the Content

Academic and vocational teachers can team teach, regularly or periodically. This may mean that an academic teacher works in the vocational classroom to teach or reinforce a particular academic concept that is to be used in a vocational task, and then the vocational teacher takes over and teaches the application of the concept. (The process would work in reverse in an academic classroom).

Another way is to have both the vocational and academic teachers teach concurrently (in either type of classroom) on some regular basis. In that way, the vocational teacher can work with a large group at times, allowing the academic teacher to provide extra help to students having difficulty.

A great benefit of both of these approaches is that students see the team members in action together and working together cooperatively. An automatic message is given out to students that the vocational and academic instruction and the material itself, are inextricably related. The idea of a total education package is reinforced for students, and the academic concepts and their application are always tied together.

Other team options that might be considered are team design and grading of assignments. The same teaming idea can be used in working with peer tutors on materials for their

students. (See **BASICS**' *Technique for Remediation: Peer Tutoring.*)

Teaming is not necessarily limited to classroom work. A team activity of a non-classroom nature is for a team to make industry visits. Vocational and academic teams can spend time—a day, a week—in the real world of work, where vocational teachers can be technically updated and academic teachers can be occupationally oriented. Another idea is that academic teachers can team up with vocational teachers on vocational student organization (VSO) responsibilities, attending activities and teaching VSO skills. For instance, the English teacher could teach public speaking and parliamentary procedure.

Staff Crossover

Staff crossover involves teachers exchanging roles with each other. The first example (given in the last section) of a team teaching the content is also a type of staff crossover in that an academic teacher presents material in a vocational classroom (or vice versa) on a task or concept basis. Staff crossover might involve even more extensive periods of swapping classrooms. If the academic and vocational teachers have both become familiar with the classes and have both developed expertise in the integrated material, they may be able to exchange classrooms very comfortably.

There are several other ways in which staff crossover can take place:

- Using consultants from other departments
- Making assignments in the other's course (For instance, the shop teacher suggests the topic for a student paper in the communications class.)
- Setting up review of student papers in which each teacher performs a different function (For instance, shop teacher reviews for content, communications teacher for language, writing, and format.)
- Attending classes in each other's course, not for evaluation purposes, but to learn from each other in a type of auditing arrangement.
- Analyzing time use in each other's classes (See **BASICS**' *Technique for Management: Time for Learning.*)

It should be clear that sharing, teaming, and staff crossover are not discrete categories. The important idea is that not every cooperative activity needs to constitute full integration and that some types of cooperation may be most suitable for launching a given joint effort.

Full integration means that the total vocational/academic program is seamless. Vocational and academic teachers work as *equal* partners in a cooperative effort to meet students' educational needs. Their interaction and mutual support are an integral part of daily instruction. In academic courses, students learn theory—deriving in large part from the vocational curriculum—from teachers who can use examples drawn from the occupation. In vocational classes, students apply that theory and reinforce their academic skills.

If, for whatever reason, teachers cannot at this time seek a fully integrated structure, there are other, less radical changes that can be implemented. At a bare minimum, there should be *cooperation* and an effort to *correlate* the two curricula. The academic skills taught should be those required for occupational entry and lifelong learning. The vocational curriculum should include the application and reinforcement of those skills insofar as possible. In both, thinking and problem solving and decision making should be used routinely and become as natural to students as breathing.

Examples of programs in which teachers have successfully used these strategies are given in the next chapter. (See also **BASICS**' *Primer of Exemplary Strategies* for more

examples of strategies for joint effort.) Many of the teachers in these programs have instituted pioneering joint efforts. Their pioneering has involved risk and challenge—primarily from the new, the different, the change from the status quo. Likewise, their pioneering efforts have brought about a unity and kinship that has often allowed outcomes that surpass expectations. The results have proven to be worth the effort. The focus is on challenge, not burden; opportunity, not imposition.

Joint Effort in Action

When embarking on a relatively new effort, teachers like to know how similar efforts are being handled by their colleagues elsewhere. The situation in each school is somewhat unique, but some elements are similar enough to strike a respondent chord and stimulate thinking. The examples and statements given here have been contributed from programs in process—programs that are in various stages in the joint effort to integrate vocational and academic education and that may still have snags to work out. All have something of value to offer those pursuing such a joint effort.

The descriptions in this section are excerpts of special interest to teachers from the lengthier descriptions of program models presented in **BASICS'** *Bridger's Guide (Integration of Academic and Vocational-Technical Education).* Teachers who would like to read about the broader program context are referred to those.

Pathfinder Regional Vocational-Technical High School District, Palmer, Massachusetts

Description

The four-year program at Pathfinder Vo-Tech High School (9-12) allows students to "explore" the various occupational programs during the first semester of the ninth grade before selecting a program. Students attend classes for five and a half hours a day, on an alternating schedule:one week of shop alternating with one week of academic and related instruction classes.

Students must successfully complete four years each of shop, related instruction, and English. The English requirement at the ninth and tenth grade levels includes both an English course and a reading course. Students must also successfully complete two years each of math, science, U.S. history, and physical education. Students must also pass shop each year and earn 150 credits in order to be eligible for a diploma. Upon successful completion of the program, students receive both a Certificate of Vocational Proficiency and a high school diploma.

The basic skills improvement plan at Pathfinder was developed with teacher, administrator, and public involvement. A school steering committee—consisting of math, reading, and English teachers (two each); an academic department head; and a central office administrator—served as a catalyst for developing the total basic skills plan. As is the case in any decision-making situation at Pathfinder, the school's advisory council was substantively involved.

An outgrowth of the steering committee's efforts was the initiation of a districtwide joint planning approach. By working with staff from the sending schools, they established a mechanism for maximum continuity in students' basic skills training, as well as for further collaboration and follow-up on a districtwide basis.

Students' basic skill needs are identified through testing. In the ninth grade, students are tested on reading, math, writing, and listening. Students who fail to meet the specified standards are given two years (grades 9 and 10) of intensive instruction in basic skills. Detailed computer analyses and scoring sheets provide the remedial instructors with the diagnostic information needed to structure each student's program to focus on identified weaknesses.

Students continue to receive remediation until they meet the standards on the yearly retest. The numbers of students requiring remediation beyond the tenth grade are not so great as to create scheduling and staffing difficulties.

A number of strategies are being used to increase the integration of the academic and vocational offerings. State minigrants are available for school systems to gain assistance in the development of curricula. Local school systems are encouraged to bring in outside consultants to help identify vocational and related academic competencies. Academic teachers can then plan instruction to cover specific occupationally related academic competencies, and vocational instructors can plan instruction to include application of those competencies. To promote mutual sharing, vocational teachers were asked to identify terms and examples from their occupational areas that the academic teachers could use in their instruction. Academic teachers were asked to identify opportunities for vocational teachers to integrate basic skills in their classes.

Massachusetts' commitment to competency-based education (CBE) also has potential for facilitating academic/vocational integration. As part of the CBE effort, local schools are developing learning activity packages (LAPs) for both the academic and the vocational courses, field testing them, and sharing them statewide. A good deal of state support and minigrants for this work are available. Staff at the regional education center in Lowell have developed a LAP development process and can provide personnel to help teachers write LAPs, for which the teachers get credit as co-authors. Elective summer programs are also offered. In these programs, teachers identify competencies for their instructional areas and then develop LAPs and other curricula. Participants are required to produce tangible products and are paid a stipend for their work.

Another opportunity for formal and informal contact between academic and vocational teachers is provided through the state's annual occupational professional development workshops, which have offered sessions covering topics such as the following:

- Integrating economics into the vocational school curriculum
- Making traditional social studies and English subjects more tangible and "real" for vocational students
- Improving listening skills
- Teaching reading in the content area
- Reinforcing basic skills through home economics
- Implementing cross-discipline planning
- Implementing Principles of Technology

Pathfinder has found that it is crucial to *market* the new approach—academic/-vocational integration—to those who will be affected. Everyone involved, furthermore, needs to understand that basic skills are an integral part of occupational preparedness. The importance of academics in the occupational program at Pathfinder is reflected in the school's promotional materials.

Staff at Pathfinder know that, traditionally, students have attended their vocational courses; they have cut their academic courses. The academic teachers who are most successful in terms of student learning and motivation are those who teach academic concepts in vocational terms. Thus, if academics are tied to vocational course work more closely in the future, this should increase attendance in academic courses—and benefit students, who need those basic skills.

For the future, vocational educators in Massachusetts are attempting to ensure that, since they are accountable for basic skills

development, they get full credit for the basic skills gains resulting from their courses. They want the state to measure students' skill levels both on entering and leaving the vocational program. They feel that improvement in basic skills, not comparison of the final skill levels of students graduating from different tracks, should be the index of program success.

For More Information

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A Joint Academic Vocational Approach (JAVA): State of Kentucky

Kentucky is another state where vocational educators are being proactive in their approach to the improvement of basic skills. To counteract a high adult illiteracy rate, Kentucky teachers are required to teach certain essential basic skills in each grade—and in each curriculum area at each grade level. In fact, a State Board of Education Regulation requires that 60 percent of a secondary student's time be devoted to basic skill development.

This commitment is reflected in the annual Kentucky Program of Studies. Under each vocational area are listed the courses offered in that area. Those vocational courses that will develop competencies in basic skills, equating to the additional unit needed to fulfill the 60 percent requirement, are marked with an asterisk.

The expansion of the introduction, practice, and reinforcement of basic skills in vocational education is listed as a goal for planning programs for fiscal year 1986. Under this goal are listed the following objectives:

- Identify basic skills that can be reinforced and practiced in 30 vocational programs.
- Develop at least two alternative implementation plans for integrating basic skills in vocational programs.
- Develop a plan that allows more secondary students to achieve vocational objectives while pursuing academic requirements.
- Implement a state school vocational guidance assessment plan for program placement and basic skills improvement.
- Identify the skills to be taught by technical related programs in state vocational technical schools, and provide the necessary instructional support.

Kentucky's commitment to competency-based education (CBE) has helped in these basic skills reinforcement efforts. Basic skills are not just inserted into the curriculum arbitrarily. Given *occupational* competencies for a program or area, teachers (who are paid to work during the summer) identify the basic skills involved in or underlying those competencies. Through the competency-based guides (for teachers or students) that are then produced, the basic skills can be infused into the curriculum where appropriate.

Under JAVA, academic skills have been cross-referenced to related tasks in prevocational programs. The skills for the prevocational areas were selected from task analyses and competency lists according to three criteria. They must (1) be exploratory (apply to as many jobs in the occupational area as possible), (2) have general educational value, and (3) represent actual job tasks (not tasks invented for the classroom). Related academic skills were identified, and task assignment sheets were developed for use by teachers and students in both the academic and prevocational areas.

Committees of academic and vocational teachers at each site took part in the development process. They worked approximately three months in the summer, during which

time they participated in staff development activities and completed such tasks as analysis of competency lists, identification of skills, and development of matrices of vocational-academic skills and curriculum materials.

Students who participate in JAVA are ninth- and tenth-grade vocational students in urban and rural schools. Materials are also available for eleventh and twelfth graders. The materials are available statewide. In rural areas, the program has been found to be most effective when the vocational school is close to the home school (otherwise so much time for transportation is taken from the program that it is difficult to implement the program fully).

For More Information

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Dauphin County Area Vocational Technical School, Harrisburg, Pennsylvania

Description

Dauphin County Area Vocational Technical School offers academic and vocational education, adult programs, and customized job training. Both full- and part-time programs are available. Area schools give their own diplomas.

The school is in its fourth year (1985-86) of planning and implementing an educational model built around clusters. Planners started by grouping vocational courses according to the Dictionary of Occupational Titles (DOT) and came up with four major clusters: service, manufacturing, construction, and communication/transportation.

Departments were subsequently abolished, and clusters became the functional organizational units. Each cluster is headed by a cluster manager and includes an academic team composed of teachers of English, math, social studies, and science.

Free elections are held to choose cluster managers. Cluster managers serve for three years and receive $1,200 extra per year for serving in that role. Two academic and two vocational teachers were the first to be elected, so there was a good balance.

Each cluster develops its own curriculum, both academic and vocational, and vocational education dollars are used to support the effort. The school feels that learning activity packages (LAPs) work best and that they are used most when teachers develop their own. Teachers, particularly the English and social studies teachers, wanted to start with a clean slate.

Some academic teachers had trouble adjusting their courses to fit the integrated cluster approach. Social studies teachers, for example, initially had difficulty identifying how their content could be occupational-specific. Now when they teach, they can, for example, include information about the labor movement and the industrial revolution.

Some vocational teachers also had adjustment problems. They felt a need—a strong need—to have the time to teach students every occupational skill they would ever need to know. The administration, on the other hand, senses that when vocational teachers think they are producing students who are prepared totally and for all time, they do students a disservice. Such students tend to think they know it all and are not amenable to later instruction and training on the job.

In the development of clusters and curriculum, planners had input from business and industry every step of the way. They took every new idea to the occupational advisory committees for approval. All curriculum, including academic curriculum, must be approved by the advisory committees. The

administration feels very strongly that the advisory committees must be consulted and *listened* to, or they won't be around very long.

New teachers are oriented to the cluster approach through the inservice training program offered as part of their induction program. Vocational and technical teachers come together for meetings; according to the administration, simple proximity does have benefits. It is difficult to find enough time for vocational/-academic sharing and curriculum development. The union contract allocates only 10 hours of inservice time per year.

An example of how academic/vocational instructors in a cluster cooperate at present is as follows. When students are given a technical writing assignment, both the English teacher and the shop teacher are involved. The English teacher helps the shop teacher select the writing format most appropriate to the specified occupational content, and the shop teacher provides the English teacher with a list of technical terms that would be used. Students receive the writing instruction they need in English class and the occupational knowledge they need in related instruction class. The completed reports are then graded by both teachers; the English teacher grades the writing skill, and the shop teacher grades the occupational content.

Student progress through the academic program is measured by math and English pre-and posttests. Monitoring progress is critical in Pennsylvania, which has mandated minimum competency levels in basic skills. Thus far, math scores are improving, but English scores are not. Pennsylvania plans to establish common-core competencies; when it does, each cluster will add area-specific competencies.

Pennsylvania also requires two humanities credits for graduation. Vocational students can earn science credit at the tech school for successfully completing the Principles of Technology course. A similar provision for humanities credits is pending in the legislature.

One clear measure of the success of the Dauphin County AVTS program is the Educational Quality Assessment Test, which is administered to students in Pennsylvania three times during their schooling. Students from Dauphin County AVTS are now in the 99th percentile. Furthermore, as the program progresses, Dauphin is finding that the teachers are becoming more and more enthusiastic about the clustering concept.

For More Information

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Program Options; State of Ohio

Description

In 1983, Ohio approved nine deliberately unconventional pilot projects at the local education agency level. Schools approved for pilot efforts agreed that their projects would (1) be occupationally specific in instructional content and design and (2) include a nonlaboratory instructional component designed to do the following:

- Reinforce basic skill competencies.
- Support the overall occupational and employability needs of students in a changing work world.
- Establish a foundation for training and retraining throughout a student's working lifetime, particularly in the areas of math, science, and/or communications.
- Complement recently modified state high school standards.
- Enhance crossover opportunities for college-bound students.

- Be cost-effective.

A Program Options model based on the pilot efforts was developed in 1985 for the integration of academic and vocational education. The model was also influenced by the new statement of goals for vocational education in Ohio, which states that by 1990 the secondary vocational education programs in Ohio will do the following:

- Reach 50 percent of the high school population in job training programs.
- Prepare students to secure gainful employment or pursue postsecondary education in the field of training at a rate that will exceed the general youth employment rate by at least 10 percent.
- Prepare students in math, science, and communication skills appropriate for entry-level positions, and provide the foundation for postsecondary education.
- Enable vocational students to demonstrate (1) occupational competencies at a level of proficiency acceptable to the employment market; (2) the ability to adapt and advance in an ever-changing work environment; and (3) employability skills, including positive work ethics, attitude, self-concept, and management of work and family responsibilities.

The model, as the name options implies, really offers a selection of models. In each model, a vocational teacher is responsible for teaching an uninterrupted minimum of 150 minutes of vocational education instruction daily. Some options cover vocational content only; other options correlate vocational education with applied academic instruction. Beyond that, there are variations.

The Program Options model includes some additional requirements for the correlated vocational/academic programs:

- Academic instruction shall be limited to applied math, science, and communications derived from specific vocational education taxonomy courses of study.
- All vocational education and academic teachers will be properly certified in their respective areas.
- Only job training vocational education students are to be enrolled in the correlated academic classes.
- Applied vocational academic classes are to be locally designed for a specific taxonomy. Clustering of vocational education programs within one or more academic classes is permissible when there is a common core of math, science, or communication concepts. Maximum class size in either case will be 25.
- All vocational education and academic teachers must attend a state-sponsored preservice workshop related to the correlation of academic and vocational education instruction.
- A correlated academic and vocational education course of study must be approved by the Divisions of Vocational Education and Elementary and Secondary Education to assure granting of credit.
- Regularly scheduled and unobligated correlation time, either daily or weekly, must be provided for vocational education teachers to plan and correlate with the appropriate academic teacher(s).
- These options do not apply to co-op programs.

To date, reports concerning Program Options are positive about both the potential and the results of this system. The document presenting the Program Options proposal (unpublished) says—

> Program Options affords students greater flexibility in meeting academic and vocational requirements, as well as provides them with the academic foundation for lifelong learning, upward employment mobility, or occupational transitioning due to changing career patterns or job dislocation.

State staff described extremely positive early results from pilot efforts. At Wayne County JVS, junior food service students showed an average 93 percent improvement in math test scores from pretest to posttest. And at Alliance City High School, an applied academic teacher, comparing his vocational students with students in the academic track, marvelled at the enthusiasm of the vocational students in the pilot; school staff and visitors were equally impressed. With these kinds of initial results—improved test scores and increased student and teacher motivation, it is no wonder that the state of Ohio has great hopes for Program Options.

For More Information

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Ohio Program Options; Great Oaks Joint Vocational School District, Cincinnati, Ohio

Description

Great Oaks Joint Vocational School District includes four campuses, serving 35 affiliate schools. Secondary (11th and 12th grade), postsecondary, and adult courses are offered, with a focus on integrating applied academics into the vocational curriculum.

In 1979, Great Oaks funded a massive employer study conducted by an independent research firm. Employers were asked 50 questions about their perceptions of vocational education and its graduates. The results showed that employers wanted to hire graduates who were (1) more flexible, (2) more capable of making lateral career changes, and (3) more capable of moving up the career ladder. They also wanted entry-level employees with better skills in math, writing, and learning how to learn.

The following year Great Oaks began working with local business and industry to reevaluate the competencies required for individuals to succeed within an occupation in a changing economy. After a two-year review process, the consensus reached by business and industry was that the skills in math, communications, and organization needed to be strengthened within each occupational area to permit upward mobility in the economic structure. It was also agreed that these skills needed to be taught by subject matter specialists and to be integrated and correlated with the occupational field of study.

Accordingly, Great Oaks initiated a limited experimental program on one of its campuses in 1982. With the success of this experimental effort, the program was implemented in the 1983-84 school year and has since been accepted by the state department of education as a model for other Ohio schools to adopt.

The Great Oaks program uses an option with an applications lab, two applied academics classes, an English class, and a class in employability skills/entrepreneurship each day. A variety of scheduling options are offered. All applications labs are taught by vocational instructors, and all academic classes are taught by teachers certified in the areas.

In the junior year, students take the applications lab (occupational and technical data), employability skills/entrepreneurship, applied math, applied science (Principles of Technology or biological and chemical science), and English. In the senior year, students take the applications lab, employability skills/entrepreneurship, applied math or science, occupational-related communication and organizational skills, and social studies.

The occupational and applied academics classes are all named to emphasize that they are part of a total integrated *vocational* program: Integrated Occupational Applications Laboratory and Integrated Technical Foundations. Great Oaks feels that in order to have a total integrated program, learners need to know that they *must* pass all these courses to earn a vocational certificate; learners must be *sold* on the total package.

Curriculum development process. Great Oaks has identified both common core basic skills competencies across occupations and competencies specifically applicable to one program or cluster of programs. In developing their Program Options model, the planners started with an available occupational analysis and used an advisory committee to help modify the task list for local conditions. Then academic and vocational teachers worked together to complete a three-step process:

- Task analysis
- Identification of objectives
- Identification of competencies needed to meet the objectives

The curriculum development process is now tied in to the normal four-year curriculum review cycle, which is combined with the inservice program for Program Options. The subsequent curriculum review and reorganization effort takes five to six months. Involving instructors in the process accustoms them to the idea of change, and then when the actual change takes place, they are ready for it.

An example of how the process works is as follows. In the summer of 1983, vocational instructors and their supervisors met for 15 days to begin the curriculum review process. After an initial orientation, they reviewed existing courses of study to determine the content to be covered in each of the two years of the program. Then they sequenced the content into duty blocks and task areas, and they identified overall objectives and competencies for each block. The last task was the most challenging:identifying the math and science skills for each duty block. Not being fully versed in math and science theory, the vocational instructors sometimes struggled with terminology, concepts, and structure.

Once the vocational instructors had done their part, math and science specialists analyzed the identified math and science skills. They, too, formed the skills into duty blocks and task areas, with objectives and competencies. And then they sequenced the math/-science duty blocks and tasks to correlate with those in the vocational course of study. Thus, the vocational curriculum determines the specific math and science concepts to be taught.

Next, time was provided for the vocational and academic instructors to work together to design strategies and develop projects integrating math/science concepts into technical application. Decisions were made, sometimes with difficulty, about who would teach what part, what materials would be used, and what instructional methods would be used. During the pilot effort, all vocational and academic instructors were put together in one large planning area, which proved to develop team spirit. In subsequent implementation efforts, however, this has not always been possible because of space limitations. Instead, instructors work in small groups, using existing facilities.

This teaming—from planning through implementation—is believed to be essential to the integrated effort. For one thing, it is impossible for two or three teachers to correlate their instruction on a continuing basis if they never communicate. More important, perhaps, is that students are more sold on the idea that the subjects are interrelated when they see their instructors working as a team. In fact, both experimental and control groups involved in the pilot effort showed that if students don't see the relationship between math, science, and their vocational training, they draw back from learning math and science.

Time for teaming—for building rapport—thus does not end when the planning phase is over. During the pilot, for example, vocational and academic teachers were required to meet for 10 minutes a day—to touch bases, to compare progress, to communicate. After three to four months, the teachers made daily contact voluntarily, without being required to do so. Teachers also continue to work as teams on curricular materials development.

Another way in which teaming is encouraged is that vocational instructors, to keep technically up-to-date, are required to make two industry visits per quarter. Now, the vocational instructors are encouraged to take the applied academic instructors with them on the visits. This not only promotes the team spirit, but also helps eliminate one of the perceived weaknesses in the program: that academic instructors lack the on-the-job technical experience needed to come up with occupational applications easily. The vocational instructor can help the academic teacher in this regard, but more is needed. In the future, Great Oaks hopes to offer an option whereby applied academic teachers, like their vocational counterparts, can enter industry every four years to participate in a 40-hour work week.

The Great Oaks district is working, on the one hand, to ensure that students reach their junior year better prepared. On the other hand, they are working to provide all students, regardless of basic skills levels, with the instruction they need to become competent. It is therefore crucial that the curriculum be somewhat individualized. For this reason, academic and vocational teachers are given time to work together (3-5 weeks during the summer and/or 2 hours a day during the school year) to develop learning activity guides (LAGs) and teacher activity guides (TAGs), job task sheets, procedure sheets, information sheets, and the like.

There is another reason for supporting the development of LAGs and TAGs. When the vocational instructors lost instructional time (e.g., from 4 ½ to 3 hours), there was a certain amount of panic. Granted, they no longer had to use their time to teach applied math and science, but they still thought they wouldn't have time to cover the vocational content. One response to this was to involve the advisory committee in reviewing the competencies to be included in the program, thus ensuring that the course content was pared to the essentials. Another response was to use different materials and strategies to deliver the content more efficiently.

Not only do teachers prepare new materials, students are now required to do more individual work outside class (e.g., readings, homework) and to prepare job plan sheets, which give directions for doing a series of operations or procedures involved in a complete job. In short, students are asked to take more responsibility for their own learning. Though students didn't automatically enjoy this "benefit" and though teachers found the curriculum development work strenuous, over time both groups are becoming convinced that the effort is worthwhile. In fact, when asked to list the advantages of the integrated approach, staff identified, among others, the following advantages:

- Student materials are better organized and of a higher quality.
- There is greater continuity in the curriculum.
- Students are able to progress at a more rapid pace.
- Through use of the job plan sheets, students are better prepared in class to complete a job or operation.
- Students have learned to apply a logical, step-by-step procedure in completing a task and solving a problem.

In terms of the integrated curriculum, numerous benefits were listed and verified by the experimental data. Teachers say that working together makes for a more meaningful day and that students benefit from having access to several experts rather than just one. Students in the experimental groups scored higher on achievement tests and technical performance tests than did students in the control group. They were also more highly motivated and had lower rates of absenteeism.

In the words of the associate superintendent, Cliff Migal, "The future looks bright." Being able to provide meaningful and concrete opportunities to relate math and science concepts and principles to the operations in the occupational field will certainly produce an individual who is better prepared to enter and advance in the labor market. The model in its present design permits the vocational competencies to be maintained at a high-quality level, while increasing the competencies in math, science, and communication skills.

For More Information

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Ohio Program Options; Mathematics at Montgomery County Joint Vocational School, Clayton, Ohio

Description

At Montgomery County Joint Vocational School (JVS), a one-year applied math/autobody course of study was developed in June of 1985, approved by the local board of education 3 months later, and sent for approval to the state's Division of Elementary and Secondary Education. From this course of study, a curriculum guide for one month's instruction was next prepared and sent in January 1986 to the state for approval; JVS staff then had until the end of the school year to complete the entire guide.

The course of study includes the following:

- Statement of board approval
- Introduction
- District philosophy
- District basic philosophical tenets
- District philosophical goals for individual development
- District educational process for goal achievement
- Mathematics program philosophy
- Program goals for applied math/autobody
- Program objectives for applied math/autobody
- Scope and sequence for applied math/autobody
- Pupil evaluation policy

The program philosophy and goals are shown in exhibit 2. An excerpt from the applied math/autobody correlation chart, developed by the vocational and academic instructors for the one-month curriculum guide, is shown in exhibit 3. In planning the lessons and the method of presentation, the academic/-vocational team then selected activities that were concrete in nature—using manipulative, job-oriented examples and direct applications to the trade. Applying the skills as soon as possible in problem-solving situations directly related to the job is highly advocated.

For More Information

Shari Wolf, Mathematics Mentor; Montgomery County Joint Vocational School; Clayton, OH 45315; (513) 837-7781

EXHIBIT 2
APPLIED MATH/AUTOBODY PHILOSOPHY & GOALS

Philosophy

Mathematics is the universal language developed by human beings as a tool to communicate quantitative and spatial ideas.

Today's society requires citizens to use mathematical skills on a daily basis for personal and/or vocational purposes. While variations in student ability exist, all students can learn mathematics. The purpose of this program is to provide students with an opportunity to gain adequate knowledge of mathematics in order to become a functioning member of a rapidly changing society.

Proficiency in fundamental arithmetical skills and understanding of mathematical concepts and their practical applications represent skills that students need in order to function in our society. As the needs of society change, proficiency in algebra, trigonometry, logic, and problem solving will be needed. The need to develop these competencies requires a structured program that presents the skills, concepts, and applications in an appropriate scope and logical sequence.

Maintaining a sequence is essential in the development of mathematical skills. Instruction should follow the sequence, ensuring proficiency at each level, in order to assure successful learning. Conceptual development is enhanced. In applying mathematics to vocational situations, students will also have the opportunity to develop more advanced mathematical skills, such as algebra, trigonometry, and geometry.

Goals

I. The student will be able to apply the four basic operations—addition, subtraction, multiplication, and division—to whole numbers, decimals, fractions, and percents.

II. The student will be able to apply measuring skills to obtain the data necessary to solve problems relevant to autobody.

III. The student will be able to apply mathematical concepts and operations to solve problems relevant to autobody, check the reasonableness of the solution, and interpret the results in terms of the original solution.

IV. The student will be able to read and interpret charts, graphs, tables, and handbooks.

V. The student will be able to use calculators and computers when appropriate.

SOURCE: Montgomery County Joint Vocational School, Clayton, OH

EXHIBIT 3
CORRELATION CHART EXCERPT: APPLIED MATH/AUTOBODY

Academic Goal I: The student will be able to apply the four basic operations—addition, subtraction, multiplication, and division—to whole numbers, decimals, fractions, and percents.

Academic Objectives	**Vocational Activities**
Whole numbers: Apply four basic operations	
Measurement using a ruler: Apply four basic operations	Analyze extent of damage to frames Operate damage dozier and attachment Repair and align a fram to manufacturer's specifications Replace the following: frame assembly, front frame section, frame horn or rear cross-member, rocker panel, front fender (bolted), cowel panel
Ruler fractions:	Determine direction of force or impact Determine hidden damage Rough out damaged panel Replace the following: front frame section, frame horn or rear cross-member, center pillar
Liquid measurement: Denominate numbers Simplify feet/inches Rename perimeter using diagrams Apply four basic operations Convert to simplest form	Mask operations Apply striping and decals Prepare for polyurethane enamel finishes Determine direction of force or impact Roughed out damaged panel Use plastic-type fillers Form sheet-metal patches Replace outer door panel Make a fiberglass patch panel

NOTE: The academic objectives (listed in the left-hand column) are met with specific application to vocational content. The math instruction focuses on the applications of math in the world of work, and the examples given and the problems solved are dra wn from the occupation.

SOURCE: Montgomery County Joint Vocational School, Clayton, OH

Principles of Technology (PT), as Applied at Detrick Vocational Center, Louisville, Kentucky

Description

As part of the requirements for graduation, students in Jefferson County Schools must earn three credits in science. Previously, these science classes were offered in the high school and might—or might not—correlate directly with students' vocational studies. Presently, Detrick Vocational Center is offering two of the necessary science credits through a state-approved course called "Special Topics in Physical Science 2564," taught by two veteran science teachers with vocational backgrounds, using the PT curriculum.

PT is a high school course in applied science that (1) helps prepare tomorrow's technicians, (2) teaches technical principles and concepts, (3) improves science and mathematics skills, and (4)provides hands-on laboratory experience. The PT curriculum is being developed by a consortium of state and provincial vocational education agencies in association with the Agency for Instructional Technology (AIT) and the Center for Occupational Research and Development (CORD). Schools in all participating states and provinces are part of a two-year pilot test (September 1984 to June 1986) of the entire system of instruction.

The PT curriculum is for eleventh and twelfth graders interested in technical careers who have completed satisfactorily one year of high school general math. The following broad-based physics concepts and principles relevant to the technological workplace are covered in 12 full units and 2 half units: force, work, rate, resistance, energy (half unit), power, force transformers, momentum (half unit), waves and vibrations, energy convertors, time constants, radiation, transducers, and optical systems. PT can satisfy one or two years of *science* requirement for high school graduation. In addition, students taking PT review and strengthen those *math* skills required for understanding and applying the technical concepts and principles.

PT can be taught by a vocational-technical teacher familiar with the physics and math covered in the materials, or by a science teacher, or by the two working together as a team. According to the developers, no teacher inservice activities are required to use the materials. (According to users at Detrick Vocational Center, PT teachers do, however, need plenty of preparation time the first year.)

In the PT curriculum, science is highly correlated with each student's specific vocational subject. Because the science teachers at Detrick have vocational backgrounds, they have been able to relate the science content to the occupational content and to develop extremely good working relationships with the vocational teachers. The science and vocational teachers share ideas and equipment and discuss the applied principles and competencies. Furthermore, the PT teachers spend one day a week in the vocational shops with the students, applying the concepts learned in the PT lab. A bridge between academics and vocational education is thus created.

The PT program has other benefits for the students, beyond the correlation of course content. They can obtain part of the required science credits at the vocational center while pursuing their vocational goals, thus allowing them more flexibility in scheduling. And because PT is taught at the vocational center, it has also attracted students who normally do not take science classes, particularly female and minority students. Of the 110 students who took PT during the first year it was offered, 20 were females and 40 were minority students.

Academically disadvantaged students also benefit. Of the 110 PT students, 67 were considered academically disadvantaged. Further-

more, approximately 30 students with reading and math deficiencies attend Detrick's learning center one day per week to receive individualized instruction, and the PT teachers work very closely with the learning center teacher—another bridge between specialties.

For More Information

Robert L. Petry, Principal, Detrick Vocational Center, 1900 South Seventh Street, Louisville, KY 40208; (502) 454-8237

A Process Model for Integrating Science Concepts and Vocational Skills; Sandy Union High School, Sandy, Oregon

Description

In the fall of 1984, Sandy Union High School implemented an integrated science/-vocational program—the Environmental Science Program—which proved to be highly successful. At Sandy High, the program began with an assessment process involving a number of activities.

Key staff (the teachers most affected) were polled, and a preliminary tally was made of science and vocational offerings that had concepts and skills in common. Since Sandy High has access to a district-owned nature site (land laboratory), the vocational areas most compatible with science were agriculture, forestry, and metals—an environmental science curriculum.

Selected teachers from the science and vocational offerings identified were brought together and first led through a brainstorming session conducted by the district superintendent. Focusing on the question, What is taught in vocational education that is also taught in science? teachers suggested topics, which were placed on the chalkboard and discussed. After the topics had been identified, the superintendent selected one topic and led the team through the process of analyzing the topic. Next, the teachers divided into groups of three to analyze, in writing, the remaining topics. Finally, the completed analyses—with coded identifier numbers—were compiled into a common curriculum that took into account the district's nature and priority vocational and science areas.

A student questionnaire was circulated among the classes identified as components of the project to gain input about their interests and needs. Based on the responses, about a dozen activities figured more prominently than others in the subsequent program writing.

The process continued with science and vocational teachers choosing goals and objectives in the selected subjects and placing them together with their companion student tasks.

The goals and objectives were synchronized. Then, through a process of reviewing information from relevant sources and using a form such as the one shown in exhibit 4, all the common pieces were put together into an integrated curriculum.

The grid in exhibit 4 can serve many functions:

- Identification, for each student project/-goal, of the course objectives, science concepts, related job titles, and student tasks (left-hand column).
- For each element listed in the left-hand column, use of the matrix on the right to identify the science and vocational classes that element relates to and the extent to which it relates: I = introduced; T = taught; and/or R = reinforced. This portrays, all on one page, how elements common to both sets of courses can be integrated.
- In the far right column, listing of any topic analyses developed during brainstorming that relate to a given element.

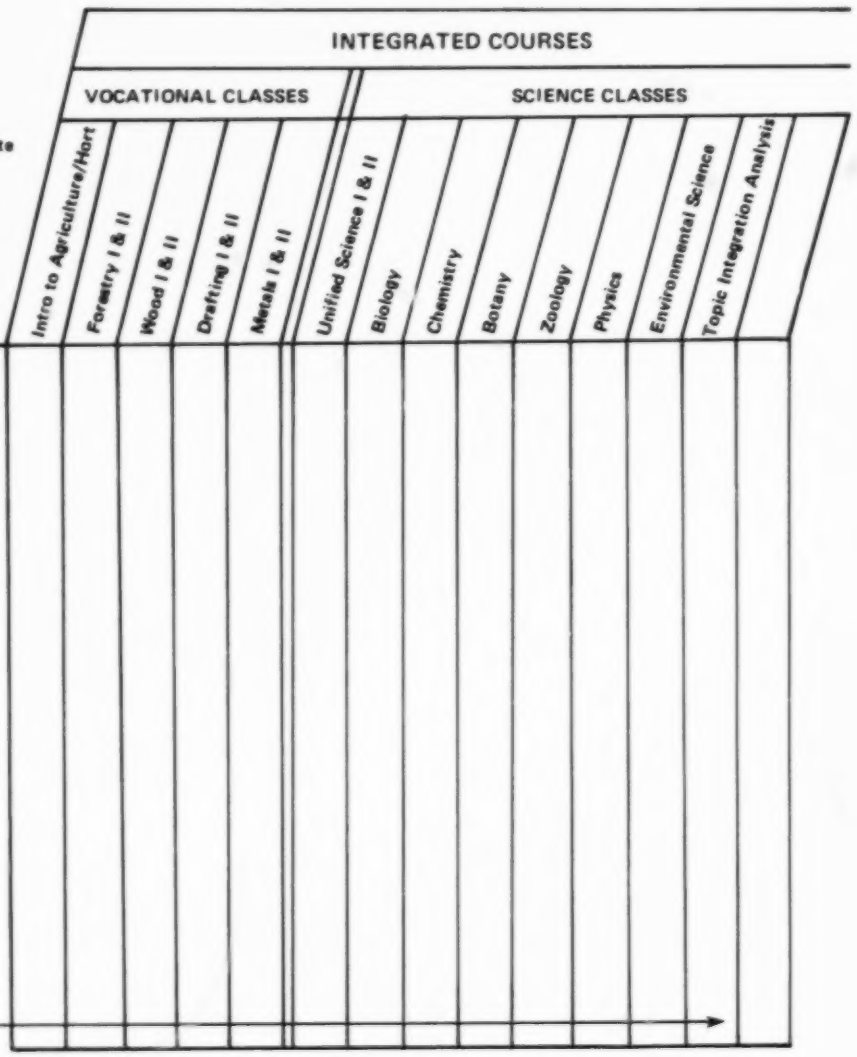
EXHIBIT 4
INTEGRATED PROGRAM GRID

GOAL: (goal statement to be written here)

I=Introduce (i.e., to bring topic or concept into use; to initiate discussion)

T=Teach (i.e., to provide systematic, formal instruction)

R=Reinforce (i.e., to strengthen instruction; to make the instruction more compelling)



This form can serve many purposes. Either objectives, concepts, or tasks may be listed. The appropriate courses should be marked with the above code. A related activity developed during brainstorming can be cross referenced here, using the identifier number at the bottom of the completed Topic Integration Analysis.

Once the grids were completed for each goal and element, program length, needed materials, target population, and credit were determined. In Sandy High's case, two units of *elective* credit are awarded for successful completion of Environmental Science. These are counted toward the 24 units required for graduation. Most of the materials were already available through existing programs.

In *A Step-by-Step Guide to Integrating Science Concepts and Vocational Skills in the High School Classroom* [1986], staff have some valuable advice to offer about key "DOs" in developing an integrated program:

- **DO** provide staff and students with an opportunity for input.
- **DO** ensure that any survey used allows those responding to *elaborate* on their views.
- **DO** ensure that the planning/development process requires science and vocational teachers to work together as a team. Most important, ensure that neither group feels their subject matter is being diluted.
- **DO** appoint and involve a project advisory committee to ensure broad-based support for the program. The committee should include equal representation (three to four members each) from four groups: educators, students, citizens, and local employers/employees.
- **DO** remember that schools already have programs in place that, when combined, do not always emerge with different basic content, but perhaps wider applicability. The integration of one curricular area with another does not necessarily imply that a district has to start over again in developing course goals and outlines. Schools can *restructure* rather than rewrite their current curricula.
- **DO** use materials already available—the vast curricular materials developed in response to state and school board mandates—to minimize the writing demands placed on the integrated program builders.
- **DO** structure the planning and development process, with activities documented in writing.
- **DO** state topics initially at a relatively high level of generality and keep them intentionally ambiguous. Consider listing concepts, instead of processes, skills, or attitudes. The more wide-ranging and flexible the topic, the greater the chance of developing an integrated instructional exercise; the more restrictive the topic, the more difficult it is to see the commonalities between areas.
- **DO** establish criteria for commonality based on factors unique to your own situation, including staff personalities (conflicts and compatibility), availability of facilities in a specific area, and most important, career goals and job interests of the students in the science program.

When asked about the benefits of the program, Dennis Crow, assistant principal and project director, responded, "We have developed a program that is almost a school within a school. There isn't a subject we can't teach in our Environmental Science class. It's a perfect alternative program for an alienated student, or a student who needs to be recovered for the system. It's also ideal for a serious science student!"

For More Information

Mr. Dennis W. Crow, Assistant Principal; Sandy Union High School District No. 2; 17100 Bluff Road; Sandy, OR 97055; (503) 668-8011. Also see *A Step-by-Step Guide to Integrating Science Concepts and Vocational Skills in the High School Classroom: The Sandy Union High School Experience*. Salem, OR: Oregon Departmentof Education, [1986]. For copies of this document, contact Dr. Alan Schultz, Specialist, Program Improvement and Data; Oregon Department of Education; 700 Pringle Parkway SE; Salem, OR 97310.

Conclusion

A number of important factors should be considered before making the commitment to joint effort that is entailed in the vocational-academic approach to teaching and to learning. These are summarized in the form of a checklist below.

- [ ] Analyze the situation
  - [ ] Identify the problem
  - [ ] Decide if teachers can respond
  - [ ] Determine how best to respond
- [ ] Identify ways teachers can work together
  - [ ] Consider sharing
  - [ ] Consider teaming
  - [ ] Consider staff crossover
- [ ] Examine joint effort in action

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